MANNEQUIN JOINTS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of U.S. Patent Application Serial No. 09/961,792, filed September 24, 2001, which is incorporated by reference in its entirety to the extent not inconsistent with the disclosure herein.

BACKGROUND

Forms or mannequins that are models of the human body are well known in the art and are used to display clothing and other merchandise. Such forms and mannequins are often complete or partial human bodies and often are of life-sized proportions. "Forms" typically refers to human shapes with or without heads, and without appendages or limbs. "Mannequins" typically refers to human shapes with or without heads, and with some or all appendages. The terms "form" and "mannequin" are used interchangeably herein, and each term incorporates the other. It is desirable that limbs can be placed in natural poses.

Examples of mannequin joint structures in the prior art include those described in Ikeda (US Patent 5,180,086); Day (US Patent 5,098,213); Schoenhut (US patent 982,096); Abbat (US Patent 5,257,873); Stringer (US Patent 4,630,762); Pansiera (US Patent 4,958,643); Kotlarsky and Gelman (US Patent 5,443,188); Bruce (US Patent 3,934,804); Strover and Strover (US Patent 5,967,790); Luke (US Patent 4,186,518); Miller (US Patent 4,955,844); Fogarty et al. (US Patent 5,308,276); Unalp and Kelley (US Patent 5,318,469); Glovier (US Patent 5,318,471); Toy (US Patent 4,545,514); Wiley et al. (US Patent 5,018,977); Jiang (US Patent 5,265,779); Neuschatz (US Patent 4,075,782); Breiden (US Patent 4,466,800); De Porteous (US Patent 5,044,960); Richards (US Patent 5,152,692); and Richards (US Patent 5,259,765).

A typical joint structure for mannequins uses a ball and socket connection means wherein a ball portion formed on a first limb member fits in and moves against the interior surface of a socket portion formed on a second limb member. The ball and socket are held in contact with each other by a locking mechanism, or fastener.

Fastening the ball and socket together results in friction between the exterior ball surface and the interior socket surface. This friction allows the limbs to be placed and held in multiple positions.

One common type of fastener for a ball and socket joint is an eyehook-spring fixture where the spring and the eyehook are located on opposite sides of a bolt. The eyehook passes through a slot on the ball and is looped around a pivot-pin that is screwed into the center portion of the ball perpendicular to the long axis of the limb. The spring is threaded onto a rod that is located in the limb above the socket. Threading the spring onto the rod forces the ball and socket together, creating the friction used to position the limbs. The use of this type of fastener also results in the appearance of a gap on the ball portion of the joint at the slot and also permits movement of the limb having the ball portion to pivot, relative to the limb with the socket, by allowing the bolt to move through the slot.

Drawbacks of these types of prior art joints include:

1. The entire limb is assembled in one step, which can be awkward.
2. An unnatural looking slot, or gap, on the ball section of these joints.
3. Poor anatomical shape of the limb.

The joint of this invention defines an improvement over the prior art in that the disclosed joint eliminates the unnatural gap on the ball section of the limb. Further, novel fastening means simplifies production and assembly of joint structures and the assembly of mannequins and forms.

SUMMARY OF THE INVENTION

In its most general form, this invention provides a mannequin having removable, positionable limb members attached thereto comprising a joint to join two of the limb members together. The joints of this invention comprise one or more assembly fixtures, located within or on a limb member to be joined, that contain elements for joining limb members. The assembly fixtures may contain elements of a locking mechanism, or fastener, and may contain other elements for joining members or creating friction or tension between limb members to be joined. For example, a socket assembly fixture is

positioned fixedly in the socket portion of a first member to be joined and comprises a chamber containing a tension-producing member and one half of a locking mechanism. A ball assembly fixture is positioned in the ball portion of a second member to be joined to said first member and comprises a second half of a locking mechanism, and means for attaching the second half of the locking mechanism to the ball portion of the second member to be joined. A joint structure is formed when two attachable limb members are joined together using one or more assembly fixtures.

This invention also provides methods for assembling the different embodiments of the joints and mannequins of this invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Figures 1A-B show a mannequin of the invention with movable, detachable limbs. Figure 1A shows a front view. Figure 1B shows a side view.

Figures 2A-C show a socket assembly fixture of this invention. Figure 2A is an exploded view. Figure 2B shows a cross-sectional view of the fixture in Figure 2A through b—b. Figure 2C shows a top view of a portion of the socket assembly fixture of Figure 2A.

Figures 3A-C show a ball assembly fixture of this invention. Figure 3A is a side view of the ball assembly fixture. Figure 3B shows a pivot pin. Figure 3C shows a side view of the ball assembly fixture of Figure 3A together with a pivot pin.

Figures 4A-B show an exploded view of the joint structure of this invention, used to join an upper leg with a lower leg. Figure 4A is a front view. Figure 4B is a side view.

Figures 5A-B show another embodiment of the joint structure of this invention at the wrist joint. Figure 5A is a top view cross-section. Figure 5B is an exploded side view.

Figures 6A-B show another embodiment of the joint structure of this invention at the wrist joint. Figure 6A is a top view cross-section. Figure 6B is an exploded side view.

Figure 7 shows another embodiment of the joint structure of this invention at the wrist joint. Figure 7 is a top view cross-section.

Figure 8 shows an exploded view of the joint structure of Figure 7.

DETAILED DESCRIPTION OF THE INVENTION

This invention describes novel joint structures for mannequins. In one embodiment of this invention, a joint structure is formed when a socket assembly fixture and ball assembly fixture are joined together.

For example, a socket assembly fixture is positioned fixedly in the socket portion of a first member to be joined and is comprised of a chamber containing a tension-producing member and one half of a locking mechanism. The tension-producing member may be made of any reversibly compressible material such as a spring, an elastomer, rubber, foam, or any other reversibly compressible material known in the art. Preferably, the tension-producing member is a spring. The locking mechanism can be a nut and bolt, a snap, a latch, dimples, a locking collar, or any other fastener or fastening means known in the art. Preferably, the locking mechanism is a threaded nut.

A ball assembly fixture is positioned in the ball portion of a second member to be joined to the first member and comprises a second half of a locking mechanism, and means for attaching the second half of the locking mechanism to the ball portion of the second member to be joined. Preferably, the second half of the locking mechanism is an eyebolt and the preferred means for attaching the eyebolt to the second member to be joined is via attachment to a disc. The disc may be molded with a groove on one of its flat surfaces to fixedly accept the eye portion of said eyebolt such that the eyebolt is held substantially in place relative to the disc surface. Alternatively, the eyebolt may be fixed to the disc using any means known in the art, including mechanical means and the use of adhesives.

The round disc is pivotally attached to the second member by any attachment means that allow the ball portion of the limb to pivot around the disc. Such attachment means are known in the art and include the use of a pivot pin and dimples. In a preferred embodiment, the attachment means is a pivot pin.

In another embodiment of this invention, a friction assembly fixture is recessed in the end of a first limb member to be joined, below the ball portion of the first limb member. A tab formed as part of, or attached to the socket surface of a second limb member, is inserted into the first limb member to contact the friction assembly fixture. Preferably, the tab is inserted into a slit formed in the first limb member. The first and second members may be held in pivotal contact using any attachment means known in the art, including a pivot pin passing through both members and dimples. Preferably, a pivot pin is inserted through both fixtures, perpendicular to the limb axis, to hold the first and second limb members in contact.

The friction assembly fixture comprises a chamber with one end open to the attaching end of the first member. This chamber contains a reversibly compressible material in its bottom and a bearing on top of the reversibly-compressible material. This reversibly-compressible material can include elastic materials such as rubber, elastomers, foam or other polymers, or may be a spring. Preferably the reversibly-compressible material is a spring. Also preferably, the spring is made of spring wire, also known as music wire or piano wire. The bearing may be made of any suitably rigid material, including plastics, metals, alloys, polymers, and the like. Preferably the bearing is made of plastic. More preferably the bearing is made of nylon.

The tab may be fixedly attached to the second limb member. The tab to be received by the friction assembly fixture may be molded as an integral part of the second limb member to be joined or it may be attached to the limb member using any attachment means known in the art, including adhesives, latches, clamps, pegs, or screws. Preferably, the tab is molded together with the second limb member to be joined.

Alternatively, the tab may be pivotally attached to the second limb member to allow rotation of the second limb member with respect to the tab. The rotation axis of the second limb member is parallel to the long axis of the second limb member. The tab may be pivotally attached by any means known to the art, including a rod fitting into a socket. The rod can be attached to the second limb member and the socket formed in the tab.

In a preferred embodiment the first and second limb members are held together with a pivot pin passing through the end of the first member and the tab of the second member to be joined such that the tab contacts the bearing in the socket assembly fixture enough to compress the reversibly compressible material. The resulting friction between the two limb members allows them to bend or to be moved relative to each other.

Optionally, one or more depressions, such as recessed dimples, grooves, or pits, are present on the surface of the tab. As the tab contacts the bearing in the socket, the bearing engages in a recessed dimple or groove on the surface of the tab. By slidably positioning the tab relative to the bearing to engage different recessed dimples or grooves, the limbs are held in one or more positions.

This invention also provides for a mannequin having the joints of this invention. "Mannequin" refers to human shapes with or without heads, and with some or all appendages. The mannequins of this invention may have one or all of the joint structures described herein. Figure 1A shows a front view of a mannequin or form of this invention with removable, freely movable, positionable, and adjustable limbs. Joint structures are present between the torso **10** and the upper arms **15** at the shoulder joint **12**, between the upper arms **15** and the lower arms **20** at the elbow joint **18**, between the lower arms **20** and the hands **25** at the wrist joint **23**, between the torso **10** and the upper legs **30** at the hip joint **22**, between the upper legs **30** and the lower legs **35** at the knee joint **32**, and between the lower leg **35** and the feet **40** at the ankle joint **38.** Figure 1B is a side view of Figure 1A.

Figure 2A shows an exploded view of a preferred embodiment of socket assembly fixture **50**. Socket assembly fixture **50** is located within a first limb member to be joined and adjacent to the molded socket surface of the first limb member (see Figure 4B). Socket assembly fixture **50** consists of chamber **60** defining cavity **63.** Cavity **63** may be any shape such as square, round, oval, triangular, and the like. Preferably chamber **60** is defined by four walls **68** and is square. Chamber **60** is attached by tack welding at the corners of chamber **60**, or by other means known in the art, to the flat surface of washer **62**, which is stamped with a recessed shape **61** (Figure 2C) to match and receive one end of chamber **60**. Washer **62** also has an opening **65** (Figure 2C) in its center that has a diameter smaller than the diameter of spring **70** (Figure 2A) so as to retain spring 70 within chamber **60.** Spring **70** fits in chamber **60** in contact with washer **62.** Nut **72,** having threads **71** is positioned on top of washer **62** in chamber **60.** Each wall **68** has a dimple **64** positioned on its surface such that the dimple is located above nut **72**. Optional cap **75** fits on top of chamber **60** such that it closes cavity **63**. Figure 2B is a cross-sectional view of the socket assembly fixture **50** in Figure 2A, through the axis b-b as it appears after assembly.

Figure 3A shows a preferred embodiment of ball assembly fixture **55** in the ball portion of the limb members to be joined. Ball assembly fixture **55** consists of a disc **80** having surface **81**, a groove (not shown) molded in surface **81**, an edge surface **84** (Figure 3c) and an opening **82** near the center of surface **81.** Ball assembly fixture **55** also consists of an eyebolt **74** having threads **76** and a looped portion **78.** The looped portion **78** of eyebolt **74** is positioned in the molded groove on surface **81** of disc **80**.

Figure 3B shows pivot pin **90** having a recessed middle portion **92** having a smaller diameter than the two outer portions **87** and **89** of pivot pin **90**. Disc **80** is rotatably mounted on pivot pin **90** with the recessed middle portion **92** of the pin engaged upon and secured within opening **82** of disc **80**. This is shown in Figure 3C, a side view of Figure 3A through c-c with pivot pin **90.**

Figure 4A is an exploded view of the knee joint **32** used to join upper leg **30** and lower leg **35.** Upper leg **30** has a socket **31** at its lower end with socket assembly fixture **50** recessed in the limb above the socket surface. Socket **31** has a hole **37** that is

aligned with an opening **65** of washer **62**. Lower leg **35** has a slot **34** extending into lower leg **35** from the center of the ball surface **33**. Lower leg **35** also has a pin channel **36** that is perpendicular to and intersects with slot **34**. Pin channel **36** may pass completely through lower leg **35** or may begin on either the lateral or medial side of lower leg **35** and pass only partially through lower leg **35**. Preferably, pin channel **36** begins on the medial side of lower leg **35** and does not pass completely through to the lateral side of lower leg **35**.

There are at least two methods of assembling the fastener to join the two limbs. In a first method for joining upper leg **30** and lower leg **35**, the threaded portion **76** of eyebolt **74** (fixedly attached to disc **80**) is inserted into socket hole **37** of upper leg **30** and opening **65** of washer **62** and passes through spring **70**. Dimples **64** and/or cap **75** retain nut **72** within chamber **60**. The eyebolt threads **76** are coupled with threads **71** of the nut **72** (Figure 2A) of socket assembly fixture **50.** Joining these threads together pulls nut **72** towards the socket **31** and puts tension on spring **70.** Next, the disc **80** of ball fixture assembly **55** is inserted into slot **34** of lower leg **35** so that disc opening **82** is aligned with pin channel **36** on lower leg **35** (Figure 2a). Finally, pivot pin **90** is inserted into pin channel **36** on lower leg **35** so that recessed portion **92** of the pivot pin **90** is located within and engages with opening **82** in the disc **80**. Thus engaged, pivot pin **90** is securely centered in disc **80**. Alternatively, lower leg **35** and ball fixture assembly **55** can be assembled as above prior to joining socket assembly fixture **50** with ball assembly fixture **55.**

Once upper leg **30** is joined to lower leg **35**, lower leg **35** is free to rotate about the axis c-c defined by eyebolt **74** (Figure 4B), and can also pivot about pivot pin **90**. Also, disc **80** effectively fills the gap found in prior art joints in which a spring-topped eyebolt only (no disc) is used to pivotally attach a ball limb member to a socket limb member. Furthermore, the distance 'f' on disc **80** is ideally slightly smaller than the diameter 'g' of the ball portion of the limb (Figure 4B). This allows the ball surface **33** to fully contact the socket surface **31**, which in turn results in greater friction between the two limb members than if only the disc edge surface **84** (Figure 3C) contacted the socket surface. This allows the limbs to be more easily held in a variety of positions. Preferably, the difference between distances f and g is between 0.100 and 0.010

inches. More preferably, the difference is between 0.060 and 0.020 inches. Most preferably, the difference is 0.040 inches.

Another embodiment of this invention is shown in Figures 5A and 5B, which illustrate a top view cross-section and a side view, respectively, of wrist joint **23** between lower arm **20** and hand **25.** In this embodiment, lower arm **20** provides the ball portion **102** of the ball and socket connection means and hand **25** provides the socket portion **103** of the ball and socket connection means.

Figure 5A shows an embodiment where tab **100** is fixedly attached to a hand. Referring to Figure 5A, lower arm **20** has a chamber **94** extending into the center of lower arm **20** below the slit **104** of the ball portion **102.** Chamber **94** contains a friction-producing assembly fixture **105**, said friction-producing assembly fixture consisting of a spring **96** and a bearing **98** positioned on top of spring **96.** Ball portion **102** of lower arm **20** also has a cavity **97** that is perpendicular to the long axis of chamber **94.** Hand **25** has tab **100** fixedly attached to the interior surface of its socket portion **103**. Tab **100** also has a center hole **95** (Figure 5B, pin **91** not shown in Figure 5B). Optionally tab **100** has one or more surface depressions, shown as dimples **101** in Figures 6A and 6B.

To assemble the wrist joint, tab **100** is inserted into slit **104** such that center hole **95** lines up with cavity **97.** With center hole **95** and cavity **97** aligned, wrist pin **91** is inserted into cavity **97** and through center hole **95** to secure hand **25** to lower arm **20**. Wrist pin **91** pivotally attaches the tab to the lower arm so that the tab can rotate about an axis parallel to the thickness of the tab. The wrist pin **91** extends through the tab and at least partly through the first limb member. Pin **91** may or may not extend completely through the first limb member. Further, when tab **100** is thus secured in slit **104**, its lower surface **93** contacts bearing **98.** The resulting tension in spring **96** causes the bearing **98** to push up against the lower surface **93** of tab **100.** This pressure causes friction between tab **100** and wrist pin **91** that allows the limbs to be placed in a variety of positions.

Alternatively, bearing **98** registers with the optional tab surface depressions, shown as dimples **101** in Figures 6A-6B (pin **91** not shown in Figure 6B), to afford

additional control over limb position. As seen in the previous embodiment, tab **100** also effectively fills the joint gap found in prior art joints. In different embodiments, the tab fills greater than or equal to about 80%, or about 85%, or about 90%, or about 95% of the width of the joint gap.

In another embodiment of the invention, tab **100** is pivotally attached to the second limb member to allow rotation of the second limb member with respect to the tab and to the first limb member. For example, for a wrist joint where the first limb member is a lower arm and the second limb member a hand, pivotal attachment of the hand to the tab allows rotation of the hand with respect to the tab, with the axis of rotation being parallel to the long axis of the hand. Once the joint is assembled, pivotal attachment of the hand to the tab also allows rotation of the hand with respect to the lower arm.

In a preferred embodiment, once the joint between the first and second limb member is assembled, the joint cannot be readily disassembled. For example, for a wrist, once the wrist joint is assembled the hand cannot be readily removed. This prevents loss of the hand from the mannequin.

Figures 7 and 8 illustrate a top view cross-section and an exploded view, respectively, of wrist joint **23** between lower arm **20** and hand **25** in which tab **100** is pivotally attached to hand **25**. The tab **100** is attached to hand **25** by a rod assembly.

The rod assembly comprises a rod **200** and socket **210**. The rod assembly is connected to tab **100** by rod **200** that fits into socket **210** in tab **100** (Figure 8). As shown in Figures 7 and 8, rod **200** may be threaded and have head **205**. Rod **200** may be a headed screw. If rod **200** is threaded, socket **210** can be correspondingly threaded to receive rod **200**. Socket **210** may comprise a metal insert in tab **100**. The rod and socket may also be affixed to one another so that no rotation of the rod within the socket occurs after the joint is assembled (e.g. by gluing the rod within the socket or otherwise locking it in place).

The rod assembly is also connected to hand **25**. As shown in Figures 7 and 8, the rod assembly may comprise threaded bushing **250** which is adapted to receive threaded rod **200**. As shown in Figures 7 and 8, bushing **250** may be threaded both internally and externally. Bushing **250** may be attached to the second limb member (the hand in Figures 7 and 8) by inserting the bushing into a threaded portion of cavity **270** formed in the second limb member, as shown in Figures 7 and 8. The bushing is typically affixed to the hand so that the bushing does not rotate within the cavity after assembly of the joint.

The joint in Figures 7 and 8 is assembled by inserting the head end of rod **200** in cavity **270**, inserting bushing **250** into cavity **270**, and then inserting rod **200** into socket **210** of tab **100**. Tab **100** is inserted into slit **104** such that center hole **95** lines up with cavity **97.** With center hole **95** and cavity **97** aligned, wrist pin **91** is inserted into cavity **97** and through center hole **95** to secure hand **25** to lower arm **20**. Wrist pin **91** pivotally attaches the tab to the lower arm so that the tab can rotate about an axis parallel to the thickness of the tab. Further, when tab **100** is thus secured in slit **104**, its lower surface **93** contacts bearing **98.** The resulting tension in spring **96** causes the bearing **98** to register with the optional tab surface depressions, shown as grooves **120,** to afford additional control over limb position. This pressure causes friction between tab **100** and wrist pin **91** that allows the limbs to be placed in a variety of positions. Alternatively, if tab surface depressions are absent, the bearing may push up against the lower surface **93** of tab **100**. As seen in the previous embodiment, tab **100** also effectively fills the joint gap found in prior art joints. In different embodiments, the tab fills greater than or equal to about 80%, or about 85%, or about 90% or about 95% of the width of the joint gap.

The joint shown in Figures 7 and 8 can be operated by fixing rod **200** within socket **210** so that the rod does not rotate within the socket. The hand **25** can then be rotated with respect to the tab **100** by movement of bushing **250** along rod **200**. Travel of the bushing along the rod is limited by contact between head **205** and bushing **250**. This contact, in combination with the fixing of rod **200** within socket **210** and the fixing of bushing **250** to hand **25**, prevents easy removal of hand **25** once the joint is assembled. Travel of the bushing along the rod may also be limited by contact between head **205**

and cavity **270** or contact between the ball **102** and socket **103** portions of the first and second limb. Preferably, the joint is designed so that rotation of the hand is limited to one and a half turns.

Prevention of easy removal of hand **25** once the joint is assembled can be achieved with other joint designs. For example, the rod **200** can be affixed to hand **25** and the rod and socket designed to prevent easy removal of the rod from the socket after assembly of the joint. For example rod **200** may have a head **205** placed within an enlarged portion of socket **210** or a c-ring may be inserted into the tab to prevent easy removal of rod **200**.

Throughout this specification, the term "limb member" refers to any movable member of a form and includes but is not limited to: head, neck, torso, upper and lower arms, hands, fingers (including all digits), upper and lower legs, feet, and toes (including all digits). The term "joint" refers to all the joints that commonly connect limb members and allow their relative movement and includes neck, shoulder, wrist, hip, knee, torso, ankle, and fingers and toes. The term "medial" refers to positions towards the center, or mid-line of the body, while the term "lateral" refers to positions towards the side of the body, opposite the medial position.

The present invention is not to be limited by the preferred embodiments described herein. Upon reading this specification, those skilled in the art will recognize various modifications thereof. Therefore, it is to be understood that such modifications are intended to fall within the scope of the appended claims.

All references cited herein are incorporated in their entirety to the extent that they are not inconsistent with the disclosure herein.